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SLIM DIGITAL AUDIO PLAYER AND RECORDER WITH CRADLE

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Field of the Invention

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Background of the Invention

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The invention relates to a portable listening device. In particular,

the invention relates to a slim digital audio player and recorder and an

accompanying cradle.

With the introduction of the MP3 music format, music has become easier to distribute and play. The MP3 format is a compression system that reduces the amount of space an audio data file occupies on a storage medium without significantly altering the quality of the information stored therein.

Accordingly, a song in the MP3 format sounds nearly the same as a song recorded in an uncompressed format such as, for example, on a compact disk yet requires less storage space on a storage medium. Therefore, because a song requires less storage space on a storage medium, it becomes easier and faster to distribute and store the music.

1 Consequently, devices that record and play MP3 formatted data
2 (i.e. MP3 players) have become popular. Particularly, portable MP3 players have
3 become popular. As with any portable device, size and weight are significant
4 factors in determining how convenient the device is to transport. Therefore,
5 there is a need to develop a smaller and more convenient portable MP3 player
6 and recorder.

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Summary of the Invention

9 The invention satisfies the aforementioned need by moving certain
10 functionality and the components that carry out such functionality from an MP3
11 player/recorder to a separate device called a cradle. By moving these
12 components, the player/recorder becomes smaller in size and lighter in weight.
13 Therefore, the player/recorder becomes more convenient to carry.

14 The invention is a combination of a digital audio player and
15 recorder for playing and recording digital data, and a cradle for receiving the
16 digital audio player and recorder. The digital audio player and recorder includes
17 a data storage device capable of receiving a data storage medium, a printed
18 circuit assembly (PCA) connected to the data storage device, a housing enclosing
19 the data storage device and the PCA and a first connector extending through the

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1 housing and connected to the PCA for transferring data between the cradle and
2 the data storage device.

3 The invention also includes the cradle that includes a receptacle
4 adapted to receive the player and recorder, a second connector adapted to
5 detachably couple with the first connector and a third connector adapted to
6 detachably couple with an external data source.

7 In accordance with another embodiment of the invention, the data
8 storage device is a disk drive that is capable of receiving a data storage cartridge
9 or disk and reading and recording digital data to the data storage cartridge or
10 disk. Also, the digital audio player and recorder further include a power source
11 such as rechargeable battery.

12 In accordance with another embodiment of the invention, a cradle
13 is provided that receives and holds a digital audio player and recorder and
14 transfers data to and from the digital audio player and recorder. The cradle
15 includes functional components that are conventionally disposed within a player
16 and recorder that are not necessary for accessing the data or playing back the
17 audio data on the player/ recorder.

18 In accordance with another embodiment of the invention, a digital
19 audio player and recorder is provided having a slim form factor. Such form
20 factor is smaller than conventionally digital audio player and recorders because

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1 certain components that do not aid in the playback of audio data are moved from
2 the player/recorder to a separate cradle.

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Brief Description of the Drawings

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Other features of the invention are further apparent from the
6 following detailed description of the invention taken in conjunction with the
7 accompanying drawings, of which:

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FIG.1 is a perspective view of an exemplary player/recorder and
9 cradle in accordance with the invention;

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FIG. 2 is a block diagram illustrating in an exemplary manner the
11 interaction of an external data source, a cradle, a player/recorder, a data storage
12 device and data storage medium in accordance with the invention;

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FIG. 3 is a perspective view of the player/recorder of FIG. 1 in
14 accordance with the invention;

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FIG. 4 is a top view of the recorder/player of FIG. 3;

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FIG. 5 is a bottom view of the recorder/player of FIG. 3;

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FIG. 6 is an exploded view of the recorder/player of FIG. 3;

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FIG. 7 is a perspective view of the cradle of FIG. 1 in accordance
19 with the invention;

1 FIG. 8 is a cross section of the cradle in FIG. 7 taken along sectional
2 lines 8-8;

3 FIG. 9 is a rear view of the cradle of FIG. 7;

4 FIG. 10 is a top view of the cradle of FIG. 7; and

5 FIG. 11 is a bottom view of the cradle of FIG. 7.

7 Detailed Description of the Invention

8 In the invention, a digital audio player and recorder and a cradle
9 are used in conjunction to transfer, play and/or store digital data, such as audio,
10 video, and the like. In accordance with the invention, the cradle contains
11 components conventionally disposed within a player/recorder that are not
12 necessary for accessing the data or playing back the audio data on the player/
13 recorder. Therefore, by placing these components in a separate cradle, the
14 player/recorder becomes lighter and more compact, and thus easier to carry
15 when removed from the cradle.

16 The cradle and player/recorder are electrically connected when the
17 player/recorder is placed in the cradle. The player/recorder and the cradle can
18 be detached from each other, so, for example a user may separately transport the
19 player/recorder and the cradle. The connection between the cradle and the

1 player/recorder allows for the transfer of data between an external data source,
2 such as a personal computer, and a storage medium in the player/recorder. In
3 addition, the connection provides electrical power to the player/recorder and
4 may recharge the power source in the player/recorder when the player/recorder
5 is in the cradle. The player/recorder can be removed from the cradle and used to
6 play the digital data stored in a storage medium that has been inserted into the
7 player/recorder or otherwise stored in the player/recorder.

8 Referring to the drawings wherein like numerals represent like
9 elements throughout, there is shown in FIG. 1 a system 5 for playing and
10 recording data in a digital format in accordance with the invention. The system 5
11 is a combination comprising a digital audio player/recorder 10 and a cradle 15.
12 As shown, cradle 15 is adapted to physically receive and hold player/recorder 10
13 by means of a receptacle 18 in the cradle 15.

14 Player/recorder 10 and cradle 15 each have an electrical connector (see
15 FIG. 5 and FIG. 10). When player/recorder 10 is inserted into receptacle 18, the
16 connector on the player/recorder 10 and the connector on the cradle 15 mate to
17 provide an electrical connection there between. The mated connectors can be
18 used to transfer data between the cradle 15 and the player/recorder 10, and to
19 and from an external data source (not shown) that may be connected to the
20 cradle 15. The mated connectors also transfer power from the cradle 15 to the

1 power source (see FIG. 6). In this sense, the power is used to recharge the power
2 source in the player/recorder 10.

3 FIG. 2 is a block diagram illustrating in an exemplary process for
4 transferring digital data between an external data source, a cradle, a
5 player/recorder, a data storage device and data storage medium in accordance
6 with the invention. In particular, FIG. 2 shows the directional flow of data in the
7 system 5. Data flows between the external data source 17 and the data storage
8 medium 55. In one embodiment of the invention, data may flow from a data
9 storage medium 55, such as a magnetic disk to an external data source 17, such as
10 a personal computer, via a data storage device 50, a player/recorder 10 and a
11 cradle 15. Likewise, in another embodiment of the invention, data may flow
12 from the external data source 17 to the data storage medium 55 via a cradle 15, a
13 player/recorder 10 and a data storage device 50. In yet another embodiment of
14 the invention and as shown in FIG. 2, data flows in both directions, i.e. from the
15 external data source 17 to the data storage medium 55 and from the data storage
16 medium 55 to the external data source 17.

17 In order to transfer data (in either direction), the data storage
18 medium 55 is inserted into the data storage device 50 of the player/recorder 10.
19 The player/recorder 20 is then inserted into cradle 15 that is connected to an
20 external data source 17.

1 FIG. 2 also shows components that may be removably connected to
2 one another. In particular, the data storage medium 55 may be removably
3 connected to the data storage device 50. The player/recorder 10 may be
4 removably connected to the cradle 15. The cradle 15 may also be removably
5 connected to the external data source 17.

6 FIG. 3 is a perspective view of the player/recorder of FIG. 1 in
7 accordance with the invention. Player/recorder 10 has a housing 20 with a front
8 31, back 32, top 33, bottom 34, left 35 and right 36 side. As shown, the housing
9 20 is substantially rectangular, however, the shape of the housing can be any
10 shape without departing from the scope of the invention.

11 The housing has a face plate 12, a back plate 14. In one
12 embodiment, the housing also includes at least one side plate 16. In this manner,
13 the face plate 12 and back plate 14 are positioned together in a planar fashion and
14 define a receptacle there between. The face plate 12 and back plate 14 can be
15 fastened together using the at least one side plate 16. In one embodiment, a
16 pressure sensitive adhesive may be used to secure the side plate 16 to the face
17 plate 12 and back plate 14 to form the housing 20. In another embodiment, the
18 side plate can be snapped to the face plate 12 and the back plate 14 to form the
19 housing 20. The at least one side plate may also be riveted or screwed to the face
20 plate 12 and back plate 14 thus securing the housing 20.

1 In one embodiment, the face plate 12 and back plate 14 are made of
2 aluminum, however, many different materials, such as, for example, plastic or
3 the like can be used for the front plate and back plate without departing from the
4 principles of the invention. In one embodiment, the side plates 16 are made of
5 stainless steel or rubber, however, many other materials may be used without
6 departing from the invention.

7 As shown in FIG. 3, there are several features on the exterior of the
8 housing 20 of the player/recorder 10. As shown, a display screen 22, such as, for
9 example, a liquid crystal display (LCD) screen, is disposed on the face plate 12 of
10 the player/recorder 10. The display screen 22 displays information to the user of
11 the player/recorder 10. Information may include, for example, the title of the
12 song currently playing, the song time remaining, track number etc. Other
13 information may be displayed without departing from the scope of the
14 invention.

15 Control buttons 25 are also disposed on the exterior of the housing
16 20 of the player/recorder 10. Control buttons 25 are used to control the playing
17 and recording of audio data. As shown, the control buttons 25 include a stop
18 button 25A, a play button 25B, a forward button 25C, a reverse button 25D,
19 menu/select button 25E and a scroll buttons 25F, 25G (e.g. up and down arrow).
20 In one embodiment of the invention, the control buttons are carbon contacts,

1 however, other button types, such as, for example, push buttons may be used
2 without departing from the scope of the invention. The location and layout of
3 the various control buttons 25 may vary without departing from the scope of the
4 invention.

5 FIG. 3 also shows a data storage medium 55. The data storage
6 medium 55 can be removably inserted into the player/recorder 10. As shown, in
7 one embodiment, the data storage medium can be inserted into a slot (such as
8 slot 30 in FIG. 4) on the top 33 of the player/recorder 10.

9 FIG. 4 is a top view of the recorder/player of FIG. 3. FIG. 4 shows
10 a slot 30 that is adapted to receive a removable data storage medium 55. The
11 removable data storage medium can be inserted in and removed from the slot 30.
12 The storage medium is capable of storing digital data. A data storage device (for
13 example, data storage device 50 in FIG. 6) is incorporated into the
14 recorder/player. The slot 30 of the player/recorder 10 corresponds to a
15 receiving slot of the data storage device 50 for receiving an appropriate data
16 storage medium 55.

17 In one embodiment, the storage medium 55 is a magnetic disk
18 cartridge such as a POCKET ZIP™ manufactured by Iomega Corporation, Roy,
19 Utah. However, other media, such as, optical or magneto-optical disks or data
20 storage cartridges can be used without departing from the principles of the

1 invention. It is contemplated that flash memory can also be used in accordance
2 with the present invention. The data storage device 50 is capable of reading and
3 writing digital data including, for example, video, audio and the like onto a data
4 storage medium. In particular, in one embodiment, the data storage device is a
5 disk drive such as the POCKET ZIP™ drive manufactured by the Iomega
6 Corporation, Roy, Utah.

7 FIG. 5 is a bottom view of the player/recorder 10. As shown, an
8 electrical connector 40 is provided in the player/recorder 10 to electrically
9 connect the player/recorder 10 to the cradle 15. The player/recorder electrical
10 connector 40 is adapted to mate with an electrical connector on the cradle (such
11 as, for example, connector 70 in FIG. 9) when the recorder/player 10 is inserted
12 into the cradle 15. As stated above, the player/recorder connector 40, when
13 mated with the connector on the cradle, allows the transfer of data from an
14 external data source through the cradle 15 to the player/recorder 10 and from
15 the player /recorder 10 through the cradle 15 to an external data source. The
16 player/recorder connector 40 also allows for the transfer of power

17 FIG. 5 also shows a headphone jack 45. The headphone jack 45 is
18 adapted to mate with a headphone plug (not shown). When mated, the user can
19 listen to audio data or the like in the player/recorder through headphones,
20 external speakers or any other conventional listening device.

1 FIG. 6 is an exploded view of the player/recorder 10. FIG. 6 shows
2 the layout of the internal components of the player/recorder 10. As shown, there
3 are three layers within the housing 20 of the player/recorder 10. The first layer
4 62 comprises a Printed Circuit Assembly (PCA) 52. The second layer 63
5 comprises a data storage device 50, such as a disk drive, and the third layer 64 is
6 a power source 54.

7 The first layer 62 is a PCA 52 that comprises a microprocessor (not
8 shown) and a controller (not shown) which controls the disk drive 50. PCA 52 is
9 connected (not shown in this figure) to buttons 25 or other activation switches on
10 the exterior of the player/recorder and allows the user to control the function of
11 the disk drive 50. In this manner, when a disk 55 is inserted in the disk drive 50,
12 the user may control the functions (e.g. play, stop, reverse or forward) of the disk
13 drive 50. PCA 52 is also connected to the display screen 22 that is protected by
14 display screen shield 67.

15 PCA 52 also includes circuitry (not shown) that controls the data
16 flow between the cradle 15 and the player/recorder 10 via the player/recorder
17 connector 40. Although FIG. 6 does not show a connection between the PCA 52
18 and the disk drive 50, one skilled in the art would appreciate the appropriate
19 connections that carrying out the functions described above.

1 The second layer 63 is a data storage device 50, such as a disk drive,
2 and is adapted to receive a data storage medium 55 for reading and recording
3 digital data such as music or other digital data to the data storage medium 55.
4 Once inserted into the disk drive 50, the disk drive 50 operates on the data on the
5 disk according to commands received from the PCA 52 (which may be controlled
6 by the buttons 25). In one embodiment, the disk drive 50 reads the data and
7 plays the data (in the form of audio music, for example) through the headphone
8 jack 45 or an alternate speaker (not shown).

9 The third layer 64 is a power source 54 that provides power to the
10 disk drive 50. In particular, the power source 54 powers the disk drive spindle
11 motor (not shown), the PCA 52, the control circuitry (not shown) and control
12 buttons 25. In one embodiment, the power source 54 is a rechargeable lithium
13 polymer battery, however, other power sources can be used without departing
14 from the scope of the invention. Preferably, the design of the battery is to
15 maintain a low form factor and thus reduce the size of the overall
16 player/recorder 10.

17 FIG. 7 is a perspective view of the cradle in FIG. 1 in accordance
18 with the invention. FIG. 7 more clearly shows the overall structure of the cradle
19 15. The cradle 15 has a substantially wide bottom that provides support for
20 holding the player/recorder as shown in FIG. 1. Additionally, the receptacle 18

1 has support walls 61 to aid in supporting the player/recorder.

2 FIG. 8 is a cross section of the cradle 15 in FIG. 7 taken along
3 sectional lines 8-8. Cradle 15 contains functional components from the
4 player/recorder 10 that are not necessary for the player/recorder to play music.
5 In one embodiment, as shown in FIG. 8, the components include a battery re-
6 charger and a USB jack. In this manner, these components can be removed from
7 the player/recorder without affecting the player/recorder's ability to play digital
8 music when the player/recorder has been removed from the cradle and is being
9 used in a portable fashion. By moving these components to the cradle 15, the
10 player/recorder has a smaller form factor, becomes lighter and easier to carry.

11 More particularly, FIG. 8 shows a cradle PCA 72. The cradle PCA
12 72 is adapted to recharge the player/recorder battery 54 when the
13 player/recorder 10 is inserted into the cradle 15. In this manner, after using the
14 player/recorder battery 54 to power the player/recorder while listening to
15 music, for example, the user places the player/recorder in the cradle 15 and
16 connects a power cord (with transformer, for example) (not shown) from an
17 external power source (such as a wall outlet) to the power input jack 76 on the
18 cradle 15. This connection serves to recharge the battery 54 in the
19 player/recorder 10. It is contemplated that the cradle PCA 72 also contains
20 components that power the player/recorder 10 while inserted in the cradle 15,

1 monitor the battery capacity and other functions associated with battery
2 charging.

3 The cradle PCA 72 also transfers data from an external data source
4 (not shown) to the player/recorder 10 when the player/recorder 10 is inserted
5 into the cradle 15 (and when the player/recorder connector 40 is connected to the
6 cradle connector 70). The player/recorder 10 can then be removed from the
7 cradle 15 and the player/recorder 10 can be used to access the data stored
8 therein.

9 The cradle 15 also contains a Uniform Serial Bus (USB) jack 74. The
10 USB jack 74 is adapted to mate with a USB cable (not shown) and can serve to
11 send and/or receive data from an external data source, such as a personal
12 computer. In this manner, a user can insert the player/recorder 10 into the
13 cradle 15 and connect a USB cable from the cradle USB jack 74 to an external data
14 source 17. Then, the user can download or otherwise transfer data from the
15 external data source 17 to a data storage medium 55 within the player/recorder
16 10.

17 FIG. 9 is a rear view of the cradle 15. FIG. 9 more clearly shows the
18 USB jack 74 and the power input jack 76. The USB jack 74 can be either Type A
19 or Type B USB socket or any sort of connection port, such as, for example, serial,
20 parallel, SCSI or firewire without departing from the scope of the invention. As

1 stated above, in one embodiment, the external data source 17 is a personal
2 computer. However, the external data source 17 can be any other device
3 including a personal data assistant (PDA), phone or any other computing or
4 telecommunications device without departing from the scope of the invention. It
5 is contemplated that the external data source 17 can also be connectable either
6 through a wireline or wireless connection to a network such as the Internet.

7 Power input jack 76 on cradle 15 is adapted to receive electrical
8 power to power the cradle 15 and player/recorder 10. In one embodiment, the
9 power input jack 76 receives 120 volt, 60 hertz AC power.

10 FIG. 10 is a top view of the cradle 15. FIG. 10 more clearly shows
11 receptacle 18 that receives and holds player/recorder 10 and the shape of the
12 base 101 of the cradle 15. As seen in this view, the base 101 of the cradle 15 is
13 substantially circular with side walls 61 extending upward from the base 101 of
14 the cradle 15 to define a receptacle 18. However, the shape of the base 101 can be
15 square, rectangular or the like without departing from the scope of the invention.
16 Additionally, the cradle connector 70 in the receptacle 18 is more clearly shown
17 in this view.

18 FIG. 11 is a bottom view of the cradle 15. A plurality of feet 100
19 extend from the bottom 103 of the cradle 15. As shown, four feet 100 extend
20 from the bottom 103 of the cradle 15. The feet 100 serve to stabilize the cradle 15

1 while holding the player/recorder 10 and while the player/recorder 10 is
2 inserted into and removed from the cradle 15. Preferably, the feet 100 are of a
3 material having a high friction characteristic to prevent the cradle 15 from
4 moving laterally along a surface (not shown). In one embodiment, the feet are
5 made of rubber, however, other materials such as, for example, plastic may be
6 used without departing from the scope of the invention.

7 As should now be understood the invention is directed to a digital
8 audio player and recorder with cradle. Changes could be made to the
9 embodiments disclosed above without departing from the broad inventive
10 concepts thereof. For example, the invention could include an optical disk drive
11 or the like without departing from the scope of the invention.

12 It is understood, therefore, that this invention is not limited to the
13 particular embodiments disclosed, but it is intended to cover modifications
14 within the scope of the present invention as defined by the appended claims.

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